

SEQUENCE LISTING



<110> IGARASHI, DAISUKE
OHSUMI, CHIEKO

<120> METHOD FOR INCREASING GLUTAMATE CONTENT OF PLANTS AND THE PLANTS HAVING
INCREASED GLUTAMATE CONTENT

<130> 246098US0XCONT

<140> 10/753,526

<141> 2004-01-09

<150> PCT/JP02/06766

<151> 2002-07-04

<150> JP 2001-208238

<151> 2001-07-09

<160> 25

<170> PatentIn version 3.1

<210> 1

<211> 481

<212> PRT

<213> Arabidopsis thaliana

<400> 1

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			20					25					30		

Leu	Gln	Lys	Glu	Gly	Lys	Lys	Val	Ile	Phe	Thr	Asn	Val	Gly	Asn	Pro
		35					40					45			

His	Ala	Leu	Gly	Gln	Lys	Pro	Leu	Thr	Phe	Pro	Arg	Gln	Val	Val	Ala
	50					55					60				

Leu	Cys	Gln	Ala	Pro	Phe	Leu	Leu	Asp	Asp	Pro	Asn	Val	Gly	Met	Leu
65					70					75					80

Phe	Pro	Ala	Asp	Ala	Ile	Ala	Arg	Ala	Lys	His	Tyr	Leu	Ser	Leu	Thr
				85					90					95	

Ser Gly Gly Leu Gly Ala Tyr Ser Asp Ser Arg Gly Leu Pro Gly Val
 100 105 110

Arg Lys Glu Val Ala Glu Phe Ile Gln Arg Arg Asp Gly Tyr Pro Ser
 115 120 125

Asp Pro Glu Leu Ile Phe Leu Thr Asp Gly Ala Ser Lys Gly Val Met
 130 135 140

Gln Ile Leu Asn Cys Val Ile Arg Gly Asn Gly Asp Gly Ile Leu Val
 145 150 155 160

Pro Val Pro Gln Tyr Pro Leu Tyr Ser Ala Thr Ile Ser Leu Leu Gly
 165 170 175

Gly Thr Leu Val Pro Tyr Tyr Leu Asp Glu Ser Glu Asn Trp Gly Leu
 180 185 190

Asp Val Ala Asn Leu Arg Gln Ser Val Ala Gln Ala Arg Ser Gln Gly
 195 200 205

Ile Thr Val Arg Ala Met Val Ile Ile Asn Pro Gly Asn Pro Thr Gly
 210 215 220

Gln Cys Leu Ser Glu Ala Asn Ile Arg Glu Ile Leu Lys Phe Cys Tyr
 225 230 235 240

Asn Glu Lys Leu Val Leu Leu Gly Asp Glu Val Tyr Gln Gln Asn Ile
 245 250 255

Tyr Gln Asp Glu Arg Pro Phe Ile Ser Ser Lys Lys Val Leu Met Glu
 260 265 270

Met Gly Ser Pro Phe Ser Lys Glu Val Gln Leu Val Ser Phe His Thr
 275 280 285

Val Ser Lys Gly Tyr Trp Gly Glu Cys Gly Gln Arg Gly Gly Tyr Phe
 290 295 300

Glu Met Thr Asn Leu Pro Pro Arg Val Val Glu Glu Ile Tyr Lys Val
 305 310 315 320

Ala Ser Ile Ala Leu Ser Pro Asn Val Ser Ala Gln Ile Phe Met Gly
 325 330 335

Leu Met Val Asn Pro Pro Lys Pro Gly Asp Ile Ser Tyr Asp Gln Phe
 340 345 350

Ala Arg Glu Ser Lys Gly Ile Leu Glu Ser Leu Arg Arg Arg Ala Arg
 355 360 365

Leu Met Thr Asp Gly Phe Asn Ser Cys Lys Asn Val Val Cys Asn Phe
 370 375 380

Thr Glu Gly Ala Met Tyr Ser Phe Pro Gln Ile Arg Leu Pro Thr Gly
 385 390 395 400

Ala Leu Gln Ala Ala Lys Gln Ala Gly Lys Val Pro Asp Val Phe Tyr
 405 410 415

Cys Leu Lys Leu Leu Glu Ala Thr Gly Ile Ser Thr Val Pro Gly Ser
 420 425 430

Gly Phe Gly Gln Lys Glu Gly Val Phe His Leu Arg Thr Thr Ile Leu
 435 440 445

Pro Ala Glu Asp Glu Met Pro Glu Ile Met Asp Ser Phe Lys Lys Phe
 450 455 460

Asn Asp Glu Phe Met Thr Gln Tyr Asp Asn Asn Phe Gly Tyr Ser Lys
 465 470 475 480

Met

<210> 2
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<220>
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<210> 3
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 ccatgatctc cggcatctca tcttc 25

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 atcacaaatc aggcacaagg ttagac 26

<210> 5
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 ggagggaaga agtgagctag ggattg 26

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<400> 6

cgtcatcct ggtatatgtt ctgctg

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ttagacaagt atctttcgga tgtg

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aacgctgcgg acatctacat ttttg

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gtgggttaat taagaattca gtacattaaa

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aagaaaatgc cgatacttca ttggc

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aagaaaatgc cgatacttca ttggc

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tagatccgaa actatcagtg

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acgtgactcc ctttaattct ccgctc

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<220>
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 cctaactttt ggtgtgatga tgctg 25

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 ttcccttaat tctccgctca tgatc 25

<210> 18
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 ttcccttaat tctccgctca tgatc 25

<210> 19
 <211> 27
 <212> DNA
 <213> Artificial Sequence

<220>
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<400> 19

gittcacatc aacattgtgg tcattgg

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<210> 20
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<212> DNA
<213> Artificial Sequence

<220>
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<400> 20
gagtacttgg gggtagtggc atcc

24

<210> 21
<211> 481
<212> PRT
<213> Arabidopsis thaliana

<400> 21

Met Ser Leu Lys Ala Leu Asp Tyr Glu Ser Leu Asn Glu Asn Val Lys
1 5 10 15

Asn Cys Gln Tyr Ala Val Arg Gly Glu Leu Tyr Leu Arg Ala Ser Glu
20 25 30

Leu Gln Lys Glu Gly Lys Lys Ile Ile Phe Thr Asn Val Gly Asn Pro
35 40 45

His Ala Leu Gly Gln Lys Pro Leu Thr Phe Pro Arg Gln Val Val Ser
50 55 60

Leu Cys Gln Ala Pro Phe Leu Leu Asp Asp Pro Asn Val Gly Met Ile
65 70 75 80

Phe Pro Ala Asp Ala Ile Ala Arg Ala Lys His Tyr Leu Ser Leu Thr
85 90 95

Ser Gly Gly Leu Gly Ala Tyr Ser Asp Ser Arg Gly Leu Pro Gly Val
100 105 110

Arg Lys Glu Val Ala Glu Phe Ile Glu Arg Arg Asp Gly Tyr Pro Ser
115 120 125

Asp	Pro	Glu	Leu	Ile	Phe	Leu	Thr	Asp	Gly	Ala	Ser	Lys	Gly	Val	Met
	130					135					140				
Gln	Ile	Leu	Asn	Cys	Val	Ile	Arg	Gly	Gln	Lys	Asp	Gly	Ile	Leu	Val
145					150					155					160
Pro	Val	Pro	Gln	Tyr	Pro	Leu	Tyr	Ser	Ala	Thr	Ile	Ser	Leu	Leu	Gly
				165					170					175	
Gly	Thr	Leu	Val	Pro	Tyr	Tyr	Leu	Glu	Glu	Ser	Glu	Asn	Trp	Gly	Leu
			180					185					190		
Asp	Val	Asn	Asn	Leu	Arg	Gln	Ser	Val	Ala	Gln	Ala	Arg	Ser	Gln	Gly
		195					200					205			
Ile	Thr	Val	Arg	Ala	Met	Val	Ile	Ile	Asn	Pro	Gly	Asn	Pro	Thr	Gly
	210					215					220				
Gln	Cys	Leu	Ser	Glu	Ala	Asn	Ile	Arg	Glu	Ile	Leu	Arg	Phe	Cys	Cys
225					230					235					240
Asp	Glu	Arg	Leu	Val	Leu	Leu	Gly	Asp	Glu	Val	Tyr	Gln	Gln	Asn	Ile
				245					250					255	
Tyr	Gln	Asp	Glu	Arg	Pro	Phe	Ile	Ser	Ser	Lys	Lys	Val	Leu	Met	Asp
			260					265						270	
Met	Gly	Ala	Pro	Ile	Ser	Lys	Glu	Val	Gln	Leu	Ile	Ser	Phe	His	Thr
		275					280					285			
Val	Ser	Lys	Gly	Tyr	Trp	Gly	Glu	Cys	Gly	Gln	Arg	Gly	Gly	Tyr	Phe
	290					295					300				
Glu	Met	Thr	Asn	Ile	Pro	Pro	Arg	Thr	Val	Glu	Glu	Ile	Tyr	Lys	Val
305					310					315					320
Ala	Ser	Ile	Ala	Leu	Ser	Pro	Asn	Val	Ser	Ala	Gln	Ile	Phe	Met	Gly
				325					330					335	

Leu Met Val Ser Pro Pro Lys Pro Gly Asp Ile Ser Tyr Asp Gln Phe
 340 345 350

Val Arg Glu Ser Lys Gly Ile Leu Glu Ser Leu Arg Arg Arg Ala Arg
 355 360 365

Met Met Thr Asp Gly Phe Asn Ser Cys Lys Asn Val Val Cys Asn Phe
 370 375 380

Thr Glu Gly Ala Met Tyr Ser Phe Pro Gln Ile Lys Leu Pro Ser Lys
 385 390 395 400

Ala Ile Gln Ala Ala Lys Gln Ala Gly Lys Val Pro Asp Val Phe Tyr
 405 410 415

Cys Leu Lys Leu Leu Glu Ala Thr Gly Ile Ser Thr Val Pro Gly Ser
 420 425 430

Gly Phe Gly Gln Lys Glu Gly Val Phe His Leu Arg Thr Thr Ile Leu
 435 440 445

Pro Ala Glu Glu Glu Met Pro Glu Ile Met Asp Ser Phe Lys Lys Phe
 450 455 460

Asn Asp Glu Phe Met Ser Gln Tyr Ala Asp Asn Phe Gly Tyr Ser Arg
 465 470 475 480

Met

<210> 22
 <211> 540
 <212> PRT
 <213> Arabidopsis thaliana

<400> 22

Met Arg Arg Phe Leu Ile Asn Gln Ala Lys Gly Leu Val Asp His Ser
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Arg Arg Gln His His His Lys Ser Pro Ser Phe Leu Ser Pro Gln Pro

20

25

30

Arg Pro Leu Ala Ser Ser Pro Pro Ala Leu Ser Arg Phe Phe Ser Ser
35 40 45

Thr Ser Glu Met Ser Ala Ser Asp Ser Thr Ser Ser Leu Pro Val Thr
50 55 60

Leu Asp Ser Ile Asn Pro Lys Val Leu Lys Cys Glu Tyr Ala Val Arg
65 70 75 80

Gly Glu Ile Val Asn Ile Ala Gln Lys Leu Gln Glu Asp Leu Lys Thr
85 90 95

Asn Lys Asp Ala Tyr Pro Phe Asp Glu Ile Ile Tyr Cys Asn Ile Gly
100 105 110

Asn Pro Gln Ser Leu Gly Gln Leu Pro Ile Lys Phe Phe Arg Glu Val
115 120 125

Leu Ala Leu Cys Asp His Ala Ser Leu Leu Asp Glu Ser Glu Thr His
130 135 140

Gly Leu Phe Ser Thr Asp Ser Ile Asp Arg Ala Trp Arg Ile Leu Asp
145 150 155 160

His Ile Pro Gly Arg Ala Thr Gly Ala Tyr Ser His Ser Gln Gly Ile
165 170 175

Lys Gly Leu Arg Asp Val Ile Ala Ala Gly Ile Glu Ala Arg Asp Gly
180 185 190

Phe Pro Ala Asp Pro Asn Asp Ile Phe Leu Thr Asp Gly Ala Ser Pro
195 200 205

Ala Val His Met Met Met Gln Leu Leu Leu Ser Ser Glu Lys Asp Gly
210 215 220

Ile Leu Ser Pro Ile Pro Gln Tyr Pro Leu Tyr Ser Ala Ser Ile Ala

225					230						235				240
Leu	His	Gly	Gly	Ser	Leu	Val	Pro	Tyr	Tyr	Leu	Asp	Glu	Ala	Thr	Gly
				245					250					255	
Trp	Gly	Leu	Glu	Ile	Ser	Asp	Leu	Lys	Lys	Gln	Leu	Glu	Glu	Ala	Arg
			260					265					270		
Ser	Lys	Gly	Ile	Ser	Val	Arg	Ala	Leu	Val	Val	Ile	Asn	Pro	Gly	Asn
		275					280					285			
Pro	Thr	Gly	Gln	Val	Leu	Ala	Glu	Glu	Asn	Gln	Arg	Asp	Ile	Val	Asn
	290					295					300				
Phe	Cys	Lys	Gln	Glu	Gly	Leu	Val	Leu	Leu	Ala	Asp	Glu	Val	Tyr	Gln
305					310					315					320
Glu	Asn	Val	Tyr	Val	Pro	Asp	Lys	Lys	Phe	His	Ser	Phe	Lys	Lys	Val
				325					330					335	
Ala	Arg	Ser	Leu	Gly	Tyr	Gly	Glu	Lys	Asp	Ile	Ser	Leu	Val	Ser	Phe
			340					345					350		
Gln	Ser	Val	Ser	Lys	Gly	Tyr	Tyr	Gly	Glu	Cys	Gly	Lys	Arg	Gly	Gly
		355					360					365			
Tyr	Met	Glu	Val	Thr	Gly	Phe	Thr	Ser	Asp	Val	Arg	Glu	Gln	Ile	Tyr
	370					375					380				
Lys	Met	Ala	Ser	Val	Asn	Leu	Cys	Ser	Asn	Ile	Ser	Gly	Gln	Ile	Leu
385					390					395					400
Ala	Ser	Leu	Val	Met	Ser	Pro	Pro	Lys	Pro	Gly	Asp	Asp	Ser	Tyr	Asp
				405					410					415	
Ser	Tyr	Met	Ala	Glu	Arg	Asp	Gly	Ile	Leu	Ser	Ser	Met	Ala	Lys	Arg
			420					425					430		
Ala	Lys	Thr	Leu	Glu	Asp	Ala	Leu	Asn	Ser	Leu	Glu	Gly	Val	Thr	Cys

435

440

445

Asn Arg Ala Glu Gly Ala Met Tyr Leu Phe Pro Arg Ile Asn Leu Pro
 450 455 460

Gln Lys Ala Ile Glu Ala Ala Glu Ala Glu Lys Thr Ala Pro Asp Ala
 465 470 475 480

Phe Tyr Cys Lys Arg Leu Leu Asn Ala Thr Gly Val Val Val Val Pro
 485 490 495

Gly Ser Gly Phe Gly Gln Val Pro Gly Thr Trp His Phe Arg Cys Thr
 500 505 510

Ile Leu Pro Gln Glu Asp Lys Ile Pro Ala Ile Val Asn Arg Leu Thr
 515 520 525

Glu Phe His Lys Ser Phe Met Asp Glu Phe Arg Asn
 530 535 540

<210> 23

<211> 545

<212> PRT

<213> Arabidopsis thaliana

<400> 23

Met Arg Arg Phe Val Ile Gly Gln Ala Lys Asn Leu Ile Asp Gln Ser
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Arg Arg Arg Gln Leu His His His Lys Asn Leu Ser Phe Val Ser Leu
 20 25 30

Ile Pro Pro Phe Ser Ala Pro Ser Asp Ser Ser Ser Arg His Leu Ser
 35 40 45

Ser Ser Ser Ser Ser Asp Met Ser Ala Ser Asp Ser Ser Ser Ser Leu
 50 55 60

Pro Val Thr Leu Asp Thr Ile Asn Pro Lys Val Ile Lys Cys Glu Tyr
 65 70 75 80

Ala	Val	Arg	Gly	Glu	Ile	Val	Asn	Ile	Ala	Gln	Lys	Leu	Gln	Glu	Asp	85	90	95	
Leu	Lys	Thr	Asn	Lys	Asp	Ala	Tyr	Pro	Phe	Asp	Glu	Ile	Ile	Tyr	Cys	100	105	110	
Asn	Ile	Gly	Asn	Pro	Gln	Ser	Leu	Gly	Gln	Gln	Pro	Ile	Thr	Phe	Phe	115	120	125	
Arg	Glu	Val	Leu	Ala	Leu	Cys	Ser	Tyr	Thr	Ala	Leu	Leu	Asp	Glu	Ser	130	135	140	
Ala	Thr	His	Gly	Leu	Phe	Arg	Phe	Ser	Ser	Asp	Ser	Ile	Glu	Arg	Ala	145	150	155	160
Trp	Lys	Ile	Leu	Asp	Gln	Ile	Pro	Gly	Arg	Ala	Thr	Gly	Ala	Tyr	Ser	165	170	175	
His	Ser	Gln	Gly	Ile	Lys	Gly	Leu	Arg	Asp	Ala	Ile	Ala	Asp	Gly	Ile	180	185	190	
Glu	Ala	Arg	Asp	Gly	Phe	Pro	Ala	Asp	Pro	Asn	Asp	Ile	Phe	Met	Thr	195	200	205	
Asp	Gly	Ala	Ser	Pro	Gly	Val	His	Met	Met	Met	Gln	Leu	Leu	Ile	Thr	210	215	220	
Ser	Glu	Lys	Asp	Gly	Ile	Leu	Cys	Pro	Ile	Pro	Gln	Tyr	Pro	Leu	Tyr	225	230	235	240
Ser	Ala	Ser	Ile	Ala	Leu	His	Gly	Gly	Thr	Leu	Val	Pro	Tyr	Tyr	Leu	245	250	255	
Asp	Glu	Ala	Ser	Gly	Trp	Gly	Leu	Glu	Ile	Ser	Glu	Leu	Lys	Lys	Gln	260	265	270	
Leu	Glu	Asp	Ala	Arg	Ser	Lys	Gly	Ile	Thr	Val	Arg	Ala	Leu	Ala	Val	275	280	285	

Ile Asn Pro Gly Asn Pro Thr Gly Gln Val Leu Ser Glu Glu Asn Gln
 290 295 300

Arg Asp Val Val Lys Phe Cys Lys Gln Glu Gly Leu Val Leu Leu Ala
 305 310 315 320

Asp Glu Val Tyr Gln Glu Asn Val Tyr Val Pro Asp Lys Lys Phe His
 325 330 335

Ser Phe Lys Lys Val Ala Arg Ser Met Gly Tyr Gly Glu Lys Asp Leu
 340 345 350

Ala Leu Val Ser Phe Gln Ser Val Ser Lys Gly Tyr Tyr Gly Glu Cys
 355 360 365

Gly Lys Arg Gly Gly Tyr Met Glu Val Thr Gly Phe Thr Ser Asp Val
 370 375 380

Arg Glu Gln Ile Tyr Lys Met Ala Ser Val Asn Leu Cys Ser Asn Ile
 385 390 395 400

Ser Gly Gln Ile Leu Ala Ser Leu Ile Met Ser Pro Pro Lys Pro Gly
 405 410 415

Asp Asp Ser Tyr Glu Ser Tyr Ile Ala Glu Lys Asp Gly Ile Leu Ser
 420 425 430

Ser Leu Ala Arg Arg Ala Lys Thr Leu Glu Glu Ala Leu Asn Lys Leu
 435 440 445

Glu Gly Val Thr Cys Asn Arg Ala Glu Gly Ala Met Tyr Leu Phe Pro
 450 455 460

Cys Leu His Leu Pro Gln Lys Ala Ile Ala Ala Ala Glu Ala Glu Lys
 465 470 475 480

Thr Ala Pro Asp Asn Phe Tyr Cys Lys Arg Leu Leu Lys Ala Thr Gly
 485 490 495

Ile Val Val Val Pro Gly Ser Gly Phe Arg Gln Val Pro Gly Thr Trp
500 505 510

His Phe Arg Cys Thr Ile Leu Pro Gln Glu Asp Lys Ile Pro Ala Ile
515 520 525

Val Asp Arg Leu Thr Ala Phe His Gln Ser Phe Met Asp Glu Phe Arg
530 535 540

Asp
545

<210> 24
<211> 39
<212> DNA
<213> Artificial Sequence

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ctgttaggtg gtactcttgt tccttactat cttgatgag

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<223> T-DNA insertion between nucleotide residues 21 and 22

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